

Research Note

Gastrointestinal Helminths of Two Gekkonid Species, *Cyrtodactylus philippinicus* and *Gekko mindorensis* (Squamata: Gekkonidae) from the Philippines

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ABSTRACT: Twenty-six gekkonid lizards from the Philippines consisting of *Cyrtodactylus philippinicus* ($n = 12$) and *Gekko mindorensis* ($n = 14$) were examined for helminths. One species of Cestoda as cyclocercoids and 6 species of Nematoda: *Bakeria schadi*, *Meteterakis longispiculata*, *Parapharyngodon maplestoni*, *Physalopteroides* sp., Pharyngodonidae gen. sp., and Physalopteridae larva, were found. Both gekkonid species harbored *Parapharyngodon maplestoni* and *Physalopteroides* sp. *Parapharyngodon maplestoni* had the highest prevalence (50%) in *C. philippinicus*. The 2 gekkonid species were parasitized by a helminth community composed of Oriental helminths. Nine new host records are reported.

KEY WORDS: Philippines, Gekkonidae, *Cyrtodactylus philippinicus*, *Gekko mindorensis*, Cestoda, Nematoda.

The Philippine archipelago supports a highly endemic diversity of reptile species, with the numbers of endemic taxa recognized throughout the archipelago having increased rapidly over the last few decades (Davis et al., 2015). Philippine gecko diversity includes species in the genera *Cyrtodactylus*, *Gekko*, *Hemidactylus*, *Hemiphyllodactylus*, *Lepidodactylus*, *Luperosaurus*, *Pseudogekko*, and *Ptychozoon*, with more than 50 species recognized in the archipelago (for review, see: Brown et al., 2012; Siler et al., 2014; Davis et al., 2015). Despite the nascent body of literature on this largely endemic radiation of lizards, the diversity of endoparasite communities associated with geckos in the Philippines remains less well understood. To date, our understanding of endoparasite diversity among Philippine reptiles, particularly helminths, relies on a handful of studies over the last century that have contributed to a baseline understanding (Bhalerao, 1927; Tubangui, 1928, 1931,

1933, 1938, 1947; Tubangui and Masilungan, 1936, 1937; Tubangui and Villaamil, 1933; Fischthal and Kuntz, 1964, 1967; Schmidt and Kuntz, 1972, 1974; Goldberg and Bursey, 2001; Goldberg et al., 2005; Kuzmin and Tkach, 2011). However, to our knowledge, there are no reports of helminths from *Cyrtodactylus philippinicus* or *Gekko mindorensis*. The purpose of this paper is to establish initial helminth lists for these 2 species as part of an ongoing survey of helminths in lizards from the Oriental region.

Cyrtodactylus philippinicus is endemic to the central and northern Philippines, where it is mainly arboreal and feeds on arthropods, including blattids and small crustaceans (*Geosesarma*) (Gaulke, 2011). *Gekko mindorensis* is endemic to the Philippines, where populations are recognized to be both arboreal and saxicolous (Gaulke, 2011). Both species are nocturnal. Dietary information on *G. mindorensis* is limited and they are known to eat crickets (Gryllidae) (Bucol et al., 2011). In general, most geckos feed on a wide variety of arthropods, reflecting their local diversity and abundance (Bauer, 2013).

Twenty-six individuals representing 2 species of geckos from the Philippines were examined for helminths: *Cyrtodactylus philippinicus* ($n = 12$), mean snout–vent length (SVL) = 85.2 mm \pm 4.7 SD, (range = 74–91 mm), collected on Mindoro Island ($n = 10$; 12°55'49.08"N, 121°5'40.92"E; World Geodetic System datum from 1984 onward [WGS-84]) and Luzon Island ($n = 2$; 16°0'00"N, 121°0'00"E; WGS-84); and *Gekko mindorensis* ($n = 14$), mean SVL = 72.2 mm \pm 4.6 SD, (range = 65–82 mm) collected on Mindoro Island (12°55'49.08"N, 121°5'40.92"E; WGS-84).

Geckos were collected by hand, euthanized within 12 hr of capture, preserved in 10% formalin, and stored in 70% ethanol (Welton et al., 2010). The

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Table 1. Number (*n*), prevalence (%), and mean intensity of infection (mean [M] ± SD) for helminths in 2 species of gekkonid lizards, *Cyrtodactylus philippinus* (*n* = 12) and *Gekko mindorensis* (*n* = 14). All are new host records.

	<i>Cyrtodactylus philippinus</i>			<i>Gekko mindorensis</i>		
	<i>n</i>	%	M ± SD	<i>n</i>	%	M ± SD
Cestoda						
Cysticercoids	6	8	6.0	—	—	—
Nematoda						
<i>Bakeria schadi</i>	9	25	3.0 ± 3.5	—	—	—
<i>Meteterakis longispiculata</i>	1	8	1.0	—	—	—
<i>Parapharyngodon maplestoni</i>	15	50	2.5 ± 1.0	5	21	1.7 ± 1.2
<i>Physalopteroides</i> sp.	5	8	5.0	1	7	1.0
Pharyngodonidae gen. sp.	—	—	—	1	7	1.0
Physalopteridae (larva)	—	—	—	1	7	1.0

body cavity was opened by a longitudinal incision, and the digestive tract was removed and opened. The esophagus, stomach, small intestine, and large intestine were examined for helminths under a dissecting microscope. Nematodes were placed on a glass slide in a drop of lactophenol, a coverslip was added, and identification was made from these temporary wet mounts. Cestodes were regressively stained in hematoxylin (Presnell and Schreiber, 1997), mounted in balsam, and examined. Cestode cysticercoids were comparable to those reported by Smyth (1994); nematodes were identified to genus using the *Keys to the Nematode Parasites of Vertebrates* (Anderson et al., 2009; Gibbons, 2010) and to species by comparison to the original descriptions. Parasite terminology is according to Bush et al. (1997). Locality data are given in Appendix 1. Specimens are deposited in the herpetology collection of the University of Kansas, Lawrence, Kansas, U.S.A. Helminths are deposited in the Harold W. Manter Parasitology Laboratory, University of Nebraska, Lincoln, U.S.A. (Appendix 2).

Seven species of helminths were found among the examined gekko specimens: 1 species of Cestoda as cysticercoids, and 6 species of Nematoda: *Bakeria schadi* Bursey, Goldberg, Grismer, 2014; *Meteterakis longispiculata* (Baylis, 1929); *Parapharyngodon maplestoni* Chatterji, 1933; *Physalopteroides* sp.; Pharyngodonidae gen. sp.; and Physalopteridae larva (Table 1). Herein we report 9 new host records.

Bakeria schadi was described by Bursey et al. (2014) from the gekko *Cnemaspis mcguirei* collected in Peninsular Malaysia. *Bakeria schadi* in *C. philippinus* is a new host record. The Philippines are a new locality record.

Meteterakis longispiculata is known to occur in lizards from Sri Lanka and lizards and snakes from

the Philippines (Baker, 1987). Besides the Philippines, species of *Meteterakis* are known from South Asia only (Baker, 1987). *Cyrtodactylus philippinus* and *Gekko mindorensis* are new host records for *Meteterakis longispiculata*.

Parapharyngodon maplestoni was observed in both host species (Table 1) and had the highest prevalence (50% in *C. philippinus*). *Parapharyngodon maplestoni* is widely distributed in South Asia (Goldberg and Bursey, 2001) and Oceania (Bursey et al. 2005a, b; Goldberg et al., 2008, 2010, 2011). *Cyrtodactylus philippinus* and *Gekko mindorensis* represent new host records for *P. maplestoni*. The Philippines are a new locality record for *P. maplestoni*.

Females of *Physalopteroides* sp. and Pharyngodonidae gen. sp. were found. Because no males were found, we can only assign the individuals to a genus or family based on Anderson et al. 2009. We assigned individuals to the Pharyngodonidae based upon their short stout body, the presence of an esophagus with bulb, and the presence of large embryonated eggs. The Pharyngodonidae is the only family of the Oxyuroidea to occur in cold-blooded vertebrates (Anderson et al., 2009). In addition, a third-stage larva assignable to the family Physalopteridae was also found.

In conclusion, *Cyrtodactylus philippinus* and *Gekko mindorensis* from the Philippines were parasitized by the Oriental parasites *Bakeria schadi*, *Meteterakis longispiculata*, and *Parapharyngodon maplestoni*. At this time, it is clear that additional work is necessary to determine the complete host lists for these 2 lizard species.

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APPENDIX 1

Collecting location for 2 species of geckos from the Philippines

Cyrtodactylus philippinicus ($n = 12$)—Mindoro Island, Occidental Mindoro Province, Lubang Municipality, Barangay Vigo: University of Kansas (KU) 303831, 303833, 303834, 303836, 303837, 303839–303841, 303844, 303847 (December 2005); Luzon

Island, Quezon Province, Sitio Kipagringau (April 2012); KU 334020; Luzon Island, Quezon Province, Sitio New Barquo: KU 334021 (April 2012).

Gekko mindorensis ($n = 14$)—Mindoro Island, Occidental Mindoro Province, Sablayan Municipality, Barangay Batong Buhay: KU 303876, 303877, 303952, 303953, 303955, 303957–303959 (February 2006), KU 308414 (March 2007); Mindoro Island, Occidental Mindoro Province, Paluan Municipality, Barangay Harrison, Sitio Ulasan: KU 308454, 308455, 308550, 308552, 308555 (January 2007).

APPENDIX 2

Helminths from 2 species of geckos from the Philippines deposited in the Harold W. Manter Parasitology Collection (HWML), University of Nebraska, Lincoln, U.S.A.

Cyrtodactylus philippinicus: *Bakeria schadi* (HWML 64734), *Meteterakis longispiculata* (HWML 64735), *Parapharyngodon maplestoni* (HWML 64736), *Physalopteroides* sp. (HWML 64737), cestode cysticercoids (HWML 64733).

Gekko mindorensis: *Parapharyngodon maplestoni* (HWML 64738), *Physalopteroides* sp. (HWML 64740), Pharyngodonidae gen. sp. (HWML 64741), Physalopteridae larva (HWML 64739).